NORTHERN CALIFORNIA BOTANISTS

BOTANICAL LEAFLETS

ISSUE 16 FALL 2015

PRESIDENT'S MESSAGE

The weather is starting to turn and it is becoming fall. I hope we get rain here in the valley and snow in the mountains this winter. We sure need it!

Our 2016 Symposium will be January 11 and 12, 2016 at CSU Chico with optional workshops on the 13th. It is going to be a great event!

2016 will be the tenth anniversary of Northern California Botanists. Isn't that amazing? We held our first symposium in 2007 and provided the first research scholarships in 2008.

I would like to thank everyone who has helped to make Northern California Botanists the success it has become. Happy anniversary! Have a great fall with your many botanical adventures. Hope to see you in January!

Linnea Hanson

NORTHERN CALIFORNIA BOTANISTS SYMPOSIUM! 11-12 JANUARY 2016—REGISTRATION IS OPEN!

The Northern California Botanists will host their 7th symposium at California State University, Chico, January 11-12, 2016 with optional workshops on the 13th. The 2016 Symposium is titled ***Plant Adaptations: Research, Conservation, and Management.*** If you or your company would like to become a sponsor, please see our webpage for details.

LIGHTNING TALKS AT THE 2016 SYMPOSIUM

This year we are offering a 5-minute per talk session. Consider giving a talk if you: are working on a project and want to give an update, are aware of an issue of concern or growing need in the botanical community, want to promote something exciting, need to hire people for an upcoming botanical project, have discovered something novel and interesting, know of new laws or regulations that the community should know about, or want to update about what your organization is doing. If you are interested in giving a lightning talk, contact jennyost@gmail.com by November 1st. Please see our website for more information.

MYSTERY PLANT

This summer and fall flower first appears to be a "California fuchsia" in the evening primrose family (Onagraceae). But there are five petals, arranged in two lips. Hummingbirds "don't care" about the number of petals—and enthusiastically visit these flowers where they commonly occur on outcrops—as photoed by Robert Fischer on a rocky slope above the Thomes Creek Gorge in the Inner North Coast Ranges. The genus, named for a botanist, is smaller than *Epilobium* too, with only seven species listed in Jepson 2.

INSIDE THIS ISSUE:

2016 NCB Symposium (continued)

Plant Adaptations: Research, Conservation, and Management will emphasize climate change in sessions titled: Educational Genetics, Managing in a Changing Climate, Locally Rare and Peripheral Plant Populations, Evolutionary California Groups, New Discoveries, Lightning Talks, and Now the Good News. The Keynote Address will be by Dr. Susan Harrison from UC Davis and will follow Monday night's banquet.

Optional workshops will follow on Wednesday, the 13th, and will include: Surveying for Rare California Bryophytes; An Expanding Threat: Exotic Phytophthora Entering Native Landscapes; and Making Herbarium-Quality Plant Specimens.

The California Botanical Society will again host a Mixer on Sunday evening Jan 10, at 5:30 at the Madison Bear Garden. Come to town early to join in on this fun social event.

Visit our webpage at http://www.norcalbotanists.org for more information.

2016 Symposium Keynote Address—Dr. Susan Harrison, UCD

We are pleased to announce Dr. Susan Harrison as the Keynote Speaker for the Northern California Botanists **2016 Symposium. Dr. Harrison is a distinguished professor from the University of California, Davis**. Her research focuses on understanding the processes that shape and maintain plant species diversity at the landscape scale, where small-scale forces such as competition and facilitation interact with large-scale forces such as niche evolution and dispersal. In recent years, much of her work has concerned the effects of climate change on plant communities in semi-arid climates. Susan's talk is titled **"Climate change and the future of diversity in California plant communities."**

The Keynote Address will follow the banquet on Monday evening, January 11, 2016 from 7:30 - 8:30 p.m. and is open to all.

Call for Posters!

The NCB symposium planning committee invites you to bring a poster to share your work and knowledge of the biology, ecology, conservation and/or management of our Northern California plant life with others at the 2016 Symposium. This will be a great opportunity for continuing education and networking.

The first session on Tuesday morning, January 12 will be a dedicated poster session. Poster authors are requested to be present with posters during a portion of the session.

Deadline for submitting Poster Abstracts is December 1, 2015. Additional information can be found on the website at: www.norcalbotanists.org/symposia_callforposters.htm

Contact Barb Castro for more information at barbcastro@hotmail.com

Symposium Stipends ($200) for College Students

Northern California Botanists will provide a number of $200 stipends to help cover expenses of travel, lodging, meals, and registration for current college students who wish to attend the NCB symposium in January 2016.

More information and the application form can be found on our webpage. Once verified, awards are given on a first-come basis. Get your applications in early!

For questions, please contact Daria Snider at dsnider@madroneeco.com. Applications must be received by December 4, 2015 and should be emailed to Daria Snider. Applicants awarded stipends will be notified by email in late December. The check for $200 can be picked up at the registration desk at the conference in January.

Requirements:

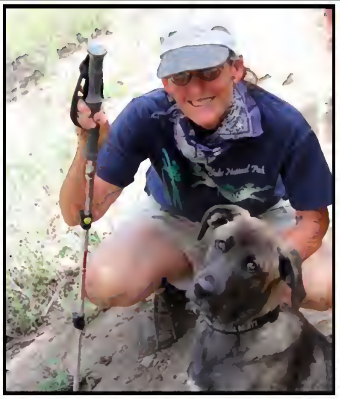
1) Must be a current college student; 2) Must provide evidence on application form of interest or involvement in plant sciences, and 3) Must register for the NCB symposium by 31 December 2015.

Answer to "Mystery Plant": *Keckiella corymbosa* (A. DC.) Straw, Bush Penstemon (Plantaginaceae, Plantain Family)

NORTHERN CALIFORNIA BOTANISTS IN ACTION

A continuing series that highlights well-known to possibly less-well-known botanists, with photographs from the present to several decades back. Please share unpublished pictures of northern California botanists: send jpegs and information to rschlising@csuchico.edu

Michael Mesler, a professor at Humboldt State University, teaches and publishes research in reproductive biology—in pteridophytes as well as in pollination of flowering plants—often in relation to the systematics of the plants (e.g., *Prosartes*). He admits to a recent "tremendously fun obsession with [native] bees," but the animals he focuses on that interact with plants have also ranged from slugs to fungus gnats and ants. He has spoken at NCB symposia. Michael is shown in the field, admiring the gummy gooseberry (*Ribes lobbii*) in this photo by Kjirsten Wayman.



Teresa Sholars, who has taught biology, botany, and ecology for 40 years at the College of the Redwoods now has the special title of "Professor Emeritus of Biology & Sustainable Agriculture." She did the treatment of *Lupinus* for Jepson 2 and is finishing work for Flora North America. She has spoken at NCB symposia, is active with the Dorothy King Young Chapter of CNPS, and serves on the editorial board of Fremontia. Her main focus now is on pygmy forest surveys (with some teaching still at COR). She provided this photo of herself and a field helper.

Dale McNeal, who attended colleges in Colorado and New York and then earned his Ph.D. at Washington State University, is now Professor Emeritus at University of the Pacific. Although he is a certified SCUBA diver, he also enjoys a day in the field on dry land, studying the California flora. In fact, to many he is known as the onion botanist for his studies on *Allium*. He co-authored the treatment of *Allium* for Flora North America, and did *Allium* and many other genera for Jepson 2. David Isle's picture shows Dale pressing *Allium obtusum* in the North Coast Ranges in 1990.

Shannon Datwyler, with a Ph.D. from The Ohio State University, is associate professor in Biological Sciences at Sacramento State University, where she teaches plant taxonomy and other courses. Her research centers on polyploidy in *Penstemon*. When the American Penstemon Society met in Chico in August of 2015, she organized field trips (with some help from the Mount Lassen Chapter of CNPS) to view many species of penstemons in the field. Linnea Hanson's photo shows Shannon admiring a wisp of the rare, *Eleocharis tortricomis* at the Butterfly Valley Botanical Area, Plumas County.

2015-2016 Student Research Scholarship Awards

Northern California Botanists is pleased to announce the recipients of this year's research scholarship awards. As in the past, we received many worthy applications. This year we awarded 8 scholarships of $1,000 each, one of which the Shasta Chapter of the California Native Plant Society (Shasta, Lassen, Modoc, and Siskiyou Counties) sponsored.

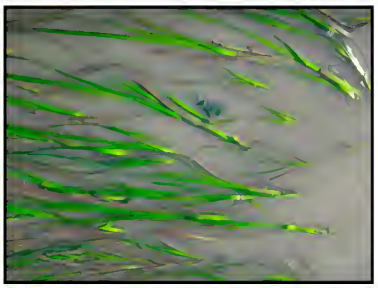
Kyle Christie is a PhD student at the University of California, Davis.

The title of his research is **"Cryptic diversity and integrative taxonomy of the *Streptanthus breweri* complex."**

California supports more endemic plant taxa than any other comparably sized area in North America and is one of the world's most species-rich biodiversity 'hotspots'. It hosts more floristic diversity than any other state in the U.S., yet is also the second most at-risk to species loss. Recent estimates suggest that over two million, and up to eight million species occur on Earth, however such assessments often fail to identify cryptic species. Cryptic species consist of two or more distinct species that have been circumscribed as a single taxon and are often difficult to distinguish based on morphology alone. In one of the most striking examples, at least six cryptic species of giraffes have been identified, all previously believed to be a single species. Accurately identifying species, the chief units of biodiversity, has broad ramifications for conservation and management, yet accurately identifying species boundaries is not simple. An integrative taxonomic approach examining morphological, genetic, biological, and ecological divergence offers promise to accurately define species, and thus uncover cryptic biodiversity. While plants are particularly amenable to integrative taxonomy this powerful approach has been largely restricted to animal groups.

The genus *Streptanthus* is comprised of ca. 35 species, the majority of which are endemic to California. Brewer's Jewelflower (*S. breweri*) is restricted to serpentine outcrops in the interior Coast Ranges, and populations occur in four distinct geographic clusters across a 500km north-south range. Population clusters are distinctly isolated in space, experience different climatic conditions, occur on varying serpentine substrates, and exhibit broad morphological variation. I am using a combination of morphometric, phylogenetic, and experimental hybridization techniques to look for cryptic diversity in this emblematic California genus. My research aims to show how integrative taxonomy can clarify patterns of biodiversity, and thus inform both basic science and important conservation decisions, and ultimately, to better understand the rich floristic diversity in California and beyond.

Crystal Weaver is a MS student at San Francisco State University.



The title of her research is **"The effects of sediments and their associated microbial communities in eelgrass (*Zostera marina*) restoration."**

Restoration of eelgrass (*Zostera marina*) is underway in a number of coastal regions, yet transplant success remains inconsistent, often for unknown reasons. Accompanying microbial communities may play a role in eelgrass germination and growth, as nitrogen fixers, sulfate reducers, and other groups have metabolic processes that make nutrients available to the plant. However, eelgrass bed sediments and the microbial communities therein are not well understood, though they may hold the key to improving restoration practices. This research investigates the microbiome of *Zostera marina* bed sediments in the San Francisco Bay Estuary, in order to inform a large eelgrass restoration program being conducted over the next decade. Using high throughput sequencing technology, this study aims to determine the connection between microbial communities and eelgrass transplant success. In addition to field sampling, a separate mesocosm experiment examines the feasibility of sediment inoculation as a means of preparing a potential restoration site for eelgrass transplanting. Early results suggest there is a distinct microbial community in extant beds relative to potential restoration sites and that microbial inoculation of mesocosm soils leads to increased eelgrass transplant success. These findings will have implications for restoration of eelgrass throughout its global distribution in temperate estuaries.

2015-2016 STUDENT RESEARCH SCHOLARSHIP AWARDS (CONT.)

Devon Thrumston is an undergraduate student at Mills College.

The title of her research is **"Is herbivory driving a genetic bottleneck in *Calochortus tiburonensis*?"**

The Tiburon Mariposa Lily, *Calochortus tiburonensis* (Liliaceae) is a rare plant, listed as Threatened by both the state and federal governments, with a CNPS listing of 1B.1. A serpentine endemic to Marin County, this species is found only on Ring Mountain. *C. tiburonensis* has a lifespan of roughly 10 years, and is capable of remaining a dormant bulb until environmental conditions are favorable for the plant to produce a leaf or flower. *C. tiburonensis* is sensitive to biotic stressors, including herbivory from jackrabbits. We are currently conducting a long-term demography study, using demographic matrix models to conduct population viability analyses (PVAs). These PVAs assess the viability of the populations of *C. tiburonensis*, and quantifies the rate at which each population grows or declines. These models also allow us to determine whether herbivory is driving a demographic bottleneck.

We observed that between 40 and 80% of the plants in our study have lost their flowering stalks to herbivory. To determine if this led to a demographic bottleneck, we used perturbation analyses to estimate population growth rates in the absence of herbivory, by estimating seed production in the absence of herbivory. While we found that heavy herbivory did not lead to a demographic bottleneck, these same data suggest that there could be a genetic bottleneck, as heavy herbivory reduces the number of individuals contributing genetic material to the next generation. This has important implications for this plant's ability to evolve in the face of climate change. *C. tiburonensis* has limited dispersal ability, cannot migrate with its preferred climate, and so must adapt *in situ* (or go extinct). A genetic bottleneck may limit its ability to do so. I will be conducting DNA fingerprinting (RFLP) on *C. tiburonensis* to assess the genetic diversity of all 1600 marked plants in our study, in order to assess the presence of a genetic bottleneck.

Moria Robinson is a PhD student at the University of California, Davis.

The title of her research is **"*From serpentine to parasitoids: multi-trophic effects of soil variation.*"**

I am interested in how soil variation shapes plant traits and how these traits influence communities of plant-feeding insects and their enemies. Specifically, I am comparing the plant-insect-parasitoid assemblages of serpentine and non-serpentine associated chaparral in McLaughlin Reserve (Lake County, CA). I utilize four plant taxa in my research: *Adenostoma* ('bodenvag', or found on both soil types), *Arctostaphylos manzanita* (non-serpentine), *A. viscida* (serpentine), *Ceanothus cuneatus* (n-s), *C. jepsonii* (s), *Quercus berberidifolia* (n-s), and *Q. durata* (s). Like many plants growing in resource-poor soils, these species have tougher leaves, lower leaf nitrogen, and lower leaf water content than their relatives in more productive soils. These traits influence the preference and performance of insect herbivores, and may alter their interactions with predators. I collect Lepidopteran (moth and butterfly) caterpillars from these plants, rearing them in the lab until an adult emerges. I use these data to construct ecological networks of interactions between all three trophic levels. So far, I have found that serpentine shrub communities host more specialized communities of herbivores and parasitoids than neighboring non-serpentine shrubs. I have also found that herbivores develop more slowly on serpentine shrubs, which may make them more vulnerable to parasitoid attack. In addition to studying these ecological patterns and processes, I am also documenting new life histories and larval morphologies of moth species found within California chaparral.

2015-2016 Student Research Scholarship Awards (Cont.)

Kristen Nelson is a MS student at California Polytechnic State University, San Luis Obispo.

The title of her research is **"Allelopathic inhibition of understory vegetation in California *Eucalyptus* groves."**

This study investigates the effects of volatile and water-soluble chemicals found in *Eucalyptus globulus* (blue gum) on the germination of California native species that have been displaced by historic *Eucalyptus* plantations throughout California. Allelopathy is a biological phenomenon in which the release of chemical compounds by one species inhibits the growth of neighboring individuals of another species. The conspicuous lack of an understory in California blue gum plantations is often attributed to the release of allelopathic chemicals from the trees, but the mechanism remains unknown. Previously, the existence of an allelopathic relationship between blue gums and various species had been tested but with widely varying results. Due to the widespread historic planting of blue gums throughout California, understanding the relationship between these trees and California vegetation has important implications for restoration and land management. In some natural ecosystems, introduced species have been shown to out-compete natives, thus altering the ecological processes of the community. Understanding the role of allelopathy in species interactions is central to understanding the stability of an ecosystem. To investigate this phenomenon in blue gums, I am conducting laboratory experiments analyzing the effects of volatile and water-soluble compounds extracted from blue gum foliage on seed germination and early seedling growth of several California natives. Volatiles from fresh blue gum leaves will be studied in an enclosed chamber; water soluble compounds will be extracted from fresh leaves by aqueous leaching using distilled water. Extracts from the leaves of coast live oak (*Quercus agrifolia*) and black sage (*Salvia mellifera*) will serve as controls. In a greenhouse experiment, I will germinate seed of native species in field-collected soils from adjacent blue gum and coastal scrub communities. This study will allow me to analyze the combined effects of volatile and water-soluble chemicals at naturally-occurring concentrations.

Andrew Weitz is a PhD student at the University of California, Berkeley.

The title of his research is **"The physiological and phylogenetic ecology of disease pressure in rapidly changing plant communities."**

Plant pathogens are important components of natural ecosystems because their effects on plant physiology can drive community diversity, structure, and dynamics. However, anthropogenic impacts on global climate, biodiversity, and habitat quality are already causing significant changes to these properties of plant communities throughout ecosystems around the world. Most notably, global vegetation dynamics are becoming increasingly mismatched and disequilibrated with changing climate due to immigration lags and extinction debts across species ranges. How these environmental changes affect plant-pathogen interactions remains largely overlooked and understudied, despite their implications on our ability to successfully predict and manage vegetation and ecosystem changes through the future. Though community-level studies of the differential impacts of pathogens on plant performance are starting to emerge, none have accounted for the fact that plant species are responding differentially to these rapid environmental changes in terms of their overall physiological performance as well as the rate at which they can track changes in climate. My research examines the joint influences of the phylogenetic and ecological structure of different plant communities in northern California on both disease pressure experienced among their community members as well as the subsequent physiological costs of disease on plant water and carbon status. I utilize experimental common gardens to both simulate future range shifts and changes in plant community composition and to test the impacts of different pathogen communities on plant performance, using foliar gas exchange measurements and carbon, oxygen, and nitrogen stable isotopes as indicators of physiological impairment. This work will provide novel insights into the roles of plant pathogens in regulating the successional trajectories of different Californian ecosystems in the face of rapid environmental change.

2015-2016 STUDENT RESEARCH SCHOLARSHIP AWARDS (CONT.)

Tommy Stoughton is a PhD student at Claremont Graduate University.

The title of his research is **"Evolution and Systematics of *Claytonia lanceolata*: untangling polyploidy origins in a challenging species complex."**

Polyploidization (whole genome duplication) is now, and likely was in the past, instrumental in the diversification of flowering plants. Polyploidy represents one of the fundamental correlates with diversification and polyploids are common elements of plant communities across the globe. New biochemical and computational techniques allow us to better estimate evolutionary histories and test hypotheses concerning the ecological, temporal, and geographic contexts of speciation. Research concerning these topics increases our understanding of gene dispersal via seeds and pollen, gene sharing among species, and the influence of chromosome number variation on plant diversification. Understanding how and why polyploidy occurs in flowering plants may provide critical insight into the interplay of adaptation and historic environmental changes.

Preliminary study indicates that the polyploid *Claytonia lanceolata* species complex (Montiaceae) consists of many 'cryptic' species inhabiting a variety of unique spatial and ecological conditions. My dissertation research is an investigation into patterns of biogeography, chromosome evolution, niche diversification, and phylogeny of the *C. lanceolata* species complex and close relatives with a special focus on segregate taxa in California. The project investigates (1) habitat characteristics to better understand mechanisms responsible for reproductive isolation, (2) chromosome number variation to relate with adaptive changes, (3) inter-specific variation in vegetation to develop hypotheses concerning the adaptive significance of leaf anatomy and morphology, and (4) patterns of gene flow to understand the extent to which species are reproductively isolated. The lattermost aim above is what has been supported by the Shasta chapter of NCB: I am investigating the genetic and morphological signatures of hybridization among sympatric sister species on Mount Eddy. This research will result in the description of several taxa new to science and provide an improved understanding of diversification in the *C. lanceolata* species complex, which is critical for effective management of the montane habitats where these plants grow.

Julia Michaels is a PhD student at the University of California, Davis.

The title of her research is **"Livestock grazing and landscape diversity in California vernal pools."**

Vernal pools are seasonal wetlands that are inundated in the winter and dry during the summer. The exotic plant species that currently dominate California grasslands are poorly adapted to seasonality in the pool basins and are mostly limited to pool edges, resulting in 'islands' of native flora within invaded grassland. Vernal pools are characterized by low within-pool diversity and exceptionally high between-pool diversity. Often, two adjacent pools of similar shape and size can be unique in their species assemblages, due to their unique combination of hydrology, chemistry, and topography.

Vernal pools are threatened by conversion of ranches to development, with conservation dependent on maintaining the economic viability of ranches. No studies have looked at the effects of grazing on between-pool (beta) diversity, which is the most prevalent form of diversity in these systems. Local disturbances and selective grazing in some upland ecosystems have been shown to enhance diversity at local sites, while homogenizing diversity between these sites. To address this question, I have compared species assemblages in vernal pools that have been grazed continuously and in pools that have been fenced off from livestock since 1970s at a site in Sacramento County. I paired 15 grazed and 15 ungrazed pools, and established nine vegetation quadrats per pool (30 pools, 270 quadrats). During peak flowering season, I sampled these quadrats for grasses and forbs and calculated richness, cover, and abundance for both individual species and for native vs. exotic species. I am currently using PermANOVA and PermDISP statistical software to compare beta diversity between the grazed and ungrazed pools.

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Chico, CA 95927-8042

NCB Symposium
January 11-12, 2016
with optional workshops
on the 13th.

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